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# forest insect & disease management methods application group

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## NEWSLETTER

### WESTERN SPRUCE BUDWORM SURVEYS

The group of entomologists working to improve western spruce budworm defoliation prediction models (described in earlier MAG newsletters) has now completed a second season of field sampling. We now have westwide egg mass density estimates for two generations (1976, 1977) and defoliation estimates for 1977, all from the same marked sample trees. Sampling has been done according to standard methods agreed upon at our last meeting in Davis in January 1977. A Progress Report distributed last spring details the methods currently being used. Entomologists from the St. Paul, Minn. (Northeastern Area) Field Office also began evaluating these sampling procedures this summer for forecasting defoliation by spruce budworm in the Lake States.

Regional personnel are converting field data to computer punch cards. A computer program has been prepared by

MAG personnel to summarize and analyze field data and compute correlations between egg mass density and defoliation by entomological sampling unit, and National Forest, for each of the western Regions. Output is in the form of three tables:

1. Egg mass densities by entomological unit in each Region.
2. Defoliation estimates by entomological unit in each Region.
3. Prediction models with correlations, regression coefficients, and standard errors of the estimates.

The egg mass-defoliation programs are quite versatile and can be used to analyze most egg mass and defoliation data gathered in the field. For example, they were used to process data on defoliation and egg-mass densities from spruce budworm pilot projects in Regions 3 and 4 during 1977.

#### WESTERN SPRUCE BUDWORM EGG MASS-DEFOLIATION SURVEY

TABLE 1 EGG MASS SAMPLING RESULTS

YEAR 77 REGION 4 FOREST 15 HOST 1 UNIT 1

CLUSTER PLOT	AV BRANCH AREA-M SQ	AV EGG MASS/M SQ	AV EGG MASS	AV ROWS	AV ROW LENGTH IN MM	
	METH 1	METH 2	METH 1	METH 2	PER BRANCH	
1	161	234	22 774	15 681	3.7	3 2
2	146	267	68 296	37 477	10 0	3 5
3	179	330	000	000	0	0
4	179	325	1 861	1 024	3	4 0
5	173	179	000	000	0	0
6	173	298	52 474	30 151	9 0	3 7
7	172	242	14 520	10 316	2 5	3 4
8	177	326	1 880	1 022	3	3 5
9	192	173	3 474	3 654	7	3 8
10	137	238	1 216	701	2	3 0
11	139	337	000	000	0	0
12	155	280	000	000	0	0
13	196	364	25 510	13 743	5 0	3 2
14	187	390	41 071	19 633	7 7	3 3
15	151	317	26 475	12 612	4 0	3 8
16	169	302	44 335	24 862	7 5	3 7
17	178	289	5 602	3 458	1 0	3 2
18	187	218	000	000	0	0
19	173	235	28 860	21 246	5 0	3 3
20	178	311	10 300	5 100	1 8	3 2
21	167	389	1 991	857	3	3 0
22	160	169	000	000	0	0
23	140	266	16 623	10 013	2 7	3 2
24	171	277	2 925	1 807	5	2 7
25	170	294	25 528	18 756	4 3	3 2
26	151	148	000	000	0	0
27	164	294	29 382	16 440	4 8	3 5
SAMPLE SIZE	27			20	20	
MEAN	168	277	15.732	9.094	2.6	3.4
STANDARD ERROR	003	012	3.626	2.030	6	071
REL SE(%)	1.723	4.463	23.046	22.319	22.5	4.570

Sample output table  
summarizing spruce  
budworm egg mass density

TABLE 2 DEFOLIATION SURVEY RESULTS

YEAR 77	REGION	4	FOREST	15	HOST	1	UNIT	1	CLUSTER (PLOT)	AVERAGE TREE1	PERCENT TREE2	DEFOLIATION TREE3	AVERAGE	ADJUSTED AVERAGE
									1	63.00	50.00	62.50	58.50	46.00
									2	64.00	64.75	84.00	70.92	58.42
									3	25.50	26.00	26.00	25.83	13.33
									4	27.00	35.00	33.75	31.92	19.42
									5	26.00	29.50	26.25	27.25	14.75
									6	72.00	68.75	69.25	70.00	57.00
									7	49.00	57.50	57.25	57.50	37.25
									8	30.50	32.00	33.75	32.08	15.58
									9	35.75	33.25	22.00	30.33	17.83
									10	34.00	38.75	32.75	35.17	22.67
									11	28.75	39.50	31.50	33.25	20.75
									12	37.75	27.50	32.75	32.67	20.17
									13	41.25	64.25	52.25	53.25	40.75
									14	39.00	66.25	41.50	48.92	36.42
									15	51.25	44.25	44.50	46.67	34.17
									16	66.50	76.75	56.25	66.50	54.00
									17	38.25	54.50	39.50	44.08	31.58
									18	27.00	27.50	26.25	26.92	14.42
									19	48.50	37.75	49.50	45.25	37.75
									20	40.50	44.00	40.00	41.00	29.50
									21	32.75	34.50	34.25	34.50	22.00
									22	27.75	25.75	25.75	26.42	13.92
									23	58.75	48.50	65.75	57.67	45.17
									24	42.25	41.00	36.50	39.92	27.42
									25	88.25	83.75	67.25	79.75	67.25
									26	25.00	26.75	26.00	25.92	13.42
									27	39.00	38.25	46.00	41.08	28.58
									SAMPLE SIZE				27	27.
									MEAN				43.57	31.07
									STANDARD ERROR				2.97	
									RELATIVE SAMPLING ERROR (PERCENT)				6.81	

## BLACK LIGHT TO DETECT WESTERN SPRUCE BUDWORM EGG MASSES

We received the following report from Wayne Bousfield (R-1) regarding their experiences with ultraviolet light for western spruce budworm egg mass detection:

"R-1 started using black light to detect spruce budworm egg masses in 1976. There was considerable hesitation that year and the black light technique was only used on a sample basis. We found that the black light detected egg masses that were missed by conventional methods.

"Minor skin irritation was eliminated by covering the fluorescent tubes with glass, which diffused the ultraviolet light waves. The work room must be completely dark, similar to a photographic darkroom, for best results. A dull matte finish white poster board with squares seems to work best for determining square centimeters of foliage. A pen-light flashlight is needed to check fluorescent particles. Unhatched and parasitized egg masses are particularly hard to detect.

*Sample output table summarizing spruce budworm defoliation*

"In 1977 we used black light on a 100 percent basis and it was much more acceptable to our workers. We increased our efficiency and accuracy by 66 percent, even after giving the crew a 5-minute break each hour."

## FOREST INSECT AND DISEASE SURVEY METHODS MANUAL

Insect and disease surveys are a major FI&DM activity. There is a need for a good reference handbook to serve as a guide in designing these surveys. MAG is now coordinating the production of a Forest Insect and Disease Survey Methods Manual which will serve this purpose and will document the best detection, evaluation, loss assessment, and post suppression surveys presently available. The manual will consist of a collection of individually authored papers describing survey methods developed for specific insects and diseases. Each paper will receive peer review before publication.

A subject outline for the manual and a general format for papers that describe survey methods have been circulated to all Regional Foresters, Station Directors, and Area Directors for their evaluation and critical review. In the review process, many good suggestions were received concerning specific survey methods to be included, along with suggestions for appropriate authors. The target for FY 78 is to have at least 11 segments of the manual (one from each western Region, two from each eastern Area) written, printed, and ready for distribution by October 1, 1978. Other segments will be added in the future.

Subject survey methods for FY 78 have been selected and qualified authors have accepted responsibility for preparing those papers. Authors will be FI&DM and FI&DR specialists and cooperators from State Agencies.

#### DWARF MISTLETOE DAMAGE SURVEYS

As part of the effort to estimate cubic foot volume loss due to dwarf mistletoes, timber inventory records were accessed for three National Forests (the Deschutes (R-6), the Medicine Bow (R-2), and the Prescott (R-3). Volume, stocking, and dwarf mistletoe data were extracted from the inventory files and placed in mass storage at the Fort Collins Computer Center. The analyses of these data are now underway.

Additional data for each of the three National Forests were also acquired. This information will allow independent estimates of volume loss for the Medicine Bow and the Prescott National Forests that can be compared to estimates derived from the inventory summaries. A dwarf mistletoe survey conducted on the Prescott in 1970 will provide an independent estimate for that forest.

During the period of July 18 to August 16, 1977, Oscar Dooling, Frank Hawksworth, Dave Johnson, Tom Harrington, Ron McDonald, and Dave Drummond conducted a road and plot survey of the Medicine Bow National Forest. The purpose of this survey was twofold: (1) acquire data for an independent estimate of volume loss attributable to dwarf mistletoe on the Medicine Bow National Forest, and (2) determine the effectiveness of road surveys to estimate loss over large areas (i.e., forests, states, and regions) where other sources of information are not available.

The Deschutes data were derived solely from timber inventory files. Two estimates will be produced, the first from the forest inventory data summary files, and the second from the actual growth data recorded in the field. These data must be transposed directly from field data forms.

Preliminary results from the Medicine Bow data suggest that while timber inventory data adequately estimated the presence or absence of the pathogen on a plot (incidence), the intensity of infection was grossly underestimated by timber inventory crews.

#### MOUNTAIN PINE BEETLE DAMAGE SURVEYS

The aerial and field phases of the pilot surveys to measure annual mortality of the mountain pine beetle in lodgepole and ponderosa pine have been completed on schedule. The almost simultaneous surveys, using aerial sketch mapping, color aerial photography, and multistage sampling techniques, were conducted on infestations in the Targhee National Forest, Idaho, and the Black Hills National Forest, South Dakota. These surveys will serve as models for providing reliable timber loss estimates on a statewide or larger basis.

The aerial photography and photo interpretation phases were an inter-regional effort. The aerial photography of the Targhee infestation was completed on August 13 by the Region 4 aerial photographic team, John Kuilouski, Jerry Jacoby, and Bob Black. The Black Hills photography was a team effort involving two aircraft, one from FI&DM R-6 and the other from Region 5. John Wear (R-6) and Bill "Beetle" Bailey (R-2) worked on one team, while Wendell Schroll (R-5) and Dick Myhre (RM), represented the other. The Black Hills photography was completed on August 26.

Assistance with the photo interpretation was provided by Jule Caylor and Walter Salazar (R-5) for the Targhee, and Emmett Wilson (R-3) for the Black Hills. MAG personnel--Lynne Whyte, Dave Grimble and Bill Klein--also assisted with the photo interpretation and photographic portions of both surveys.

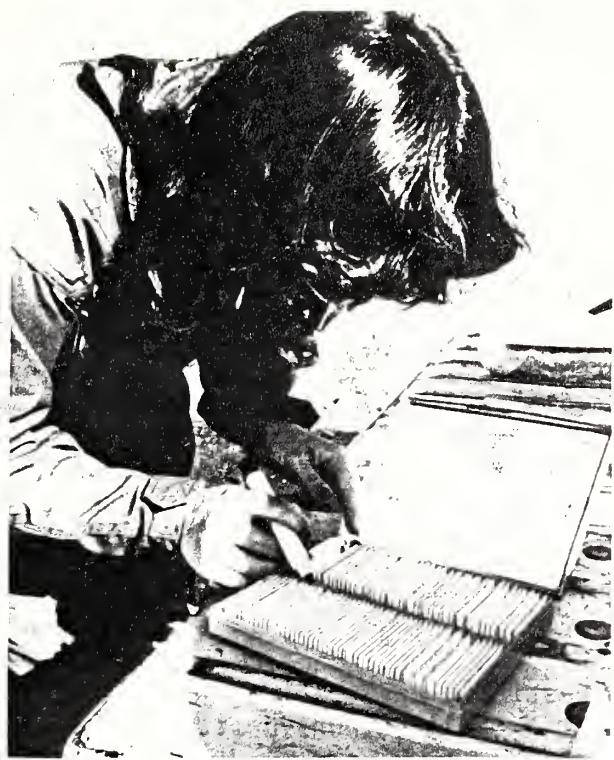
There was concern that the field portions of the surveys may be jeopardized by unseasonably inclement weather. This was particularly true of the Targhee National Forest, where early snow storms are the rule rather than the exception. However, during the ground phase the weather remained excellent. The Targhee and Black Hills ground surveys were completed on September 20 and October 3, respectively.

Data from both surveys is now being checked, compiled and analyzed at MAG. Analysis of data from the Targhee National Forest indicates that this survey procedure can provide estimates of current mortality in terms of acres infested, number of trees infested and cubic foot volume loss with a sampling error of less than 10 percent in lodgepole pine stands infested by mountain pine beetle.

## EVALUATION OF HUGHES 500D HELICOPTER

The Forest Service participated in an evaluation of a Hughes 500D helicopter in cooperation with the Department of Agricultural Engineering, University of California, Davis. Forest Service participants included Pacific Southwest Forest and Range Experiment Station (PSW), Missoula Equipment Development Center (MEDC), and MAG. The purpose of the project, conducted the week of November 7, 1977, was to evaluate the new Hughes 500D helicopter equipped with a Chadwick Spray System for agricultural and forestry use in applying pesticides. This was accomplished by conducting a series of spray runs and spraying a dyed tank mix over a variety of samplers. This process, commonly referred to as aircraft characterization, provides baseline data of spray deposition and swath width under a variety of meteorological conditions. Another objective of the project was to obtain data on air-borne drift and spray accountancy. This was accomplished by an intensive array of deposit and air concentration samplers positioned over one mile downwind. UC Davis provided meteorological sensors on towers. Data were telemetered to a van where they were interpreted and recorded for instant readout.

The USFS (MAG and PSW) assisted in deposit sampling. Tony Jasumback and Bob Ekblad of MEDC provided additional meteorological sampling equipment supported by a helium-filled balloon and an on-flight recorder to record aircraft speed, flow rates, etc.



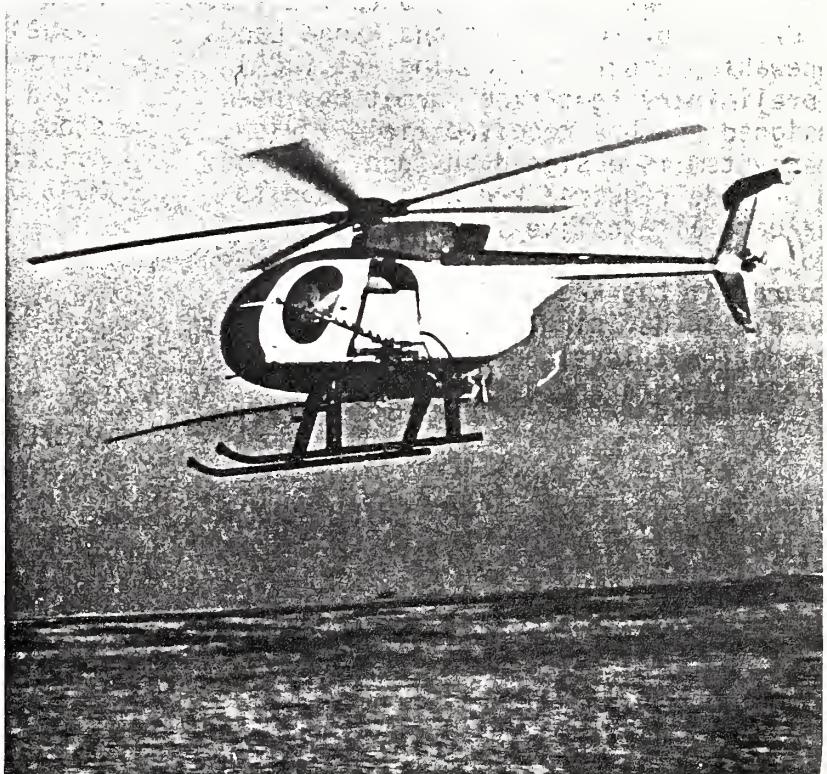
*Lynne Whyte (MAG) prepares Magnesium oxide slides for deposit sampling*



*Jack Armstrong and Bob Cowden (UC Davis) place spray deposit samplers on grid*



*Bob Ekblad (MEDC) and Pat Shea (PSW) prepare instrumentation for weather monitoring*



*Hughes 500D in flight*

## DFTM OUTBREAK MODEL

The Douglas-fir Tussock Moth (DFTM) "Outbreak" Model is installed at the Fort Collins Computer Center (FCCC). Bob Young and John Wong from MAG collaborated with Jim Colbert of Oregon State University, one of the principal developers of the DFTM model, in converting the programs to the FCCC system during the first week of November. By directly accessing these programs (now stored at FCCC), several test runs have been made through MAG's terminals. Action is being initiated now to conduct additional test runs using available field data. These test runs should provide valuable information for model validation and for preparation of a user manual for this model.

## FI&DM PLANNING AND ACCOMPLISHMENT REPORTING

MAG is providing assistance in design of procedures for reporting FI&DM accomplishments in primary output units, as defined by the Forest and Range Lands Renewable Resources Planning Act (RPA). A preliminary reporting format has been designed and has received field review. The system is designed in such a way as to provide required RPA outputs and to evaluate alternative funding levels and projected accomplishments of an FI&DM program at the Regional and Area level, and aid in defining data requirements at the national level on status of major forest insects and diseases.

## CRANFIELD INSTITUTE--A WORLDWIDE LOOK AT AERIAL APPLICATION OF PESTICIDES

Jack Barry presented an invited lecture entitled "Aircraft in Forest Pest Control--United States" at the Cranfield Institute of Technology, College of Aeronautics, Cranfield, England, in September 1977. Each year the Institute offers a short course on the aerial application of pesticides to students worldwide. The course is oriented toward

providing the pest manager with the latest technology and methods to plan, conduct and evaluate aerial application of pesticides. The 55 students represented 17 countries and disciplines which included agriculture, economics, biology, engineering, physics, chemistry and industrial management. Problems such as drift, aircraft guidance, drop size control, atomization, deposit sampling, meteorology, safety, etc., were recognized as worldwide concerns. The short course provides a focal point for practitioners to discuss and exchange ideas on current practices and future trends involving aerial application.

Cranfield Institute is planning to offer, beginning 1978, a one-year M.Sc. program on "The Technology and Management of Pesticide Application" jointly with Imperial College, University of London.

Also of interest to those involved in aerial application is the establishment of the International Agricultural Aviation Centre at Cranfield. The Centre issues a quarterly publication entitled "Agricultural Aviation." Those interested in membership and/or a subscription should write International Agricultural Aviation Centre, Cranfield, Bedford, MK43 0AL, England.

## PEOPLE, PUBLICATIONS AND PRESENTATIONS

JANET ZACHARIAS has been promoted from unit clerk-typist to secretary. She filled the position vacated by PAM ELAM, who accepted an assignment on the Six Rivers National Forest in Northern California.

JULIET HART has accepted an appointment as clerk-typist for the group. Julie is new to the Federal Government and a recent graduate of UC Davis.

BILL CIESLA presented a paper entitled "Color vs. Color I.R. Photos for Forest Insect Surveys" at the Sixth Biennial Workshop in Color Photography in the Plant Sciences, held at Ft. Collins, Colorado.

DAVE DRUMMOND participated in a panel on Knowledge Utilization at the Western International Forest Disease Work Conference in Victoria, British Columbia, where he discussed information analysis, applications and pilot projects. Dave was "elected" secretary-treasurer for the 1978 Annual Meeting which will be held in Tucson, Arizona.

JACK BARRY and BILL CIESLA have been appointed as chapter editor and coeditor respectively of two chapters of the Douglas-fir Tussock Moth Compendium, to be issued as the final report of the USDA Expanded Douglas-fir Tussock Moth Research and Development Program. Jack will serve as editor of the chapter dealing with aerial applications technology, and Bill will coedit the chapter on population management-chemical control in conjunction with JED DEWEY, entomologist in Region 1, Missoula, Montana.

LYNNE WHYTE was invited by the Department of Agricultural Engineering, UC Davis, to participate in a series of tests measuring downwind drift of insecticide conducted during a mosquito control project in Goosevalley, California, during July. Eight different sampling techniques were employed to measure the amount of aerosol penetrating the forested area. Results of the tests are expected to be available this month.

MARSHALL SHAPIRO and TONY LEBAR, both students at UC Davis, are assisting members of the MAG team in data analysis, photo interpretation, and other activities on a part-time basis under sponsorship of the college work-study program.

#### PUBLICATIONS BY MAG STAFF:

Ciesla, W.M. 1977. Douglas-fir tussock moth: direct control with chemical and microbial insecticides. Bulletin. Entomol. Soc. America, 23:174-6

Barry, J.W. 1977. Problems associated with maintaining consistent swaths when spraying forests with helicopters. Agric. Aviation 18 (3) 18-22.

Young, R.W., R.C. Luebbe and J.W. Barry. 1977. ASCAS data management systems for assessment of aerial spray deposits. USDA Forest Service, Forest Insect and Disease Management, Methods Application Group, Davis, California. Report No. 77-2. 29 pp.

Young, R.W. 1977. Comparison of two computerized mapping systems for analysis, storage and retrieval of forest insect and disease survey data. USDA Forest Service, Forest Insect and Disease Management, Methods Application Group, Davis, California. Report No. 77-4. 28 pp.



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